WHAT IS CLAIMED IS:

1. A method of controlling a refrigeration cycle of an automotive air conditioner,

characterized by estimating a differential pressure between a high pressure-side refrigerant pressure and a low pressure-side refrigerant pressure in the refrigeration cycle and a flow rate of refrigerant flowing therethrough, based on a first external electric signal for controlling the differential pressure between the high pressure-side refrigerant pressure and the low pressure-side refrigerant pressure in the refrigeration cycle or the flow rate of refrigerant flowing therethrough and a second external electric signal for controlling a size of a refrigerant passage in the refrigeration cycle, and estimating a compressor variable displacement ratio and driving torque of a compressor based on the estimated differential pressure and flow rate of refrigerant and an engine rotational speed; and

controlling the first external electric signal and the second external electric signal such that refrigerating capacity of the refrigeration cycle is maximized when the automotive air conditioner is started, efficiency of the refrigeration cycle is maximized when the vehicle is in a steady traveling condition, and the driving torque of the compressor is reduced when the vehicle is in an accelerating condition.

2. The method of controlling the refrigeration cycle according to claim 1, wherein the first external electric signal is a control signal for controlling displacement of a variable displacement compressor, the control signal determinng a flow rate of refrigerant flowing through the variable displacement compressor, and wherein the second external electric signal is a control signal for determining a differential pressure between a high pressure-side refrigerant pressure and a low pressure-side refrigerant pressure in an expansion device.

3. The method of controlling the refrigeration cycle according to claim 2, wherein the first external electric signal is a signal for a control valve that controls the flow rate of refrigerant to a constant value by sensing a differential pressure across a fixed orifice provided in a refrigerant passage through which refrigerant flows and controlling a pressure within a crank chamber of the variable displacement compressor.

4. The method of controlling the refrigeration cycle according to claim 2, wherein the first external electric signal is a signal for a flow rate control valve disposed in a refrigerant passage through which refrigerant flows, to form a variable orifice, and wherein a constant differential pressure valve controls a pressure within a

crank chamber of the variable displacement compressor such that a differential pressure across the flow rate control valve is held constant.

5. The method of controlling the refrigeration cycle according to claim 1, wherein the first external electric signal is a control signal for controlling displacement of a variable displacement compressor, the control signal determining a flow rate of refrigerant flowing through the variable displacement compressor, and wherein the second external electric signal is a signal for proportionally controlling an area of a refrigerant passage in an expansion device.

6. The method of controlling the refrigeration cycle according to claim 5, wherein the first external electric signal is a signal for a control valve that controls the flow rate of refrigerant to a constant value by sensing a differential pressure across a fixed orifice provided in a refrigerant passage through which refrigerant flows and controlling a pressure within a crank chamber of the variable displacement compressor.

7. The method of controlling the refrigeration cycle according to claim 5, wherein the first external electric signal is a signal for a flow rate control valve disposed in a refrigerant passage through which refrigerant flows,

to form a variable orifice, and wherein a constant differential pressure valve controls a pressure within a crank chamber of the variable displacement compressor such that a differential pressure across the flow rate control valve is held constant.

8. The method of controlling the refrigeration cycle according to claim 1, wherein the first external electric signal is a control signal for controlling displacement of a variable displacement compressor, the control signal determining a differential pressure between a high pressure-side refrigerant pressure and a low pressure-side refrigerant pressure in the variable displacement compressor, and wherein the second external electric signal is a control signal for determining a flow rate of refrigerant flowing through an expansion valve.

9. The method of controlling the refrigeration cycle according to claim 1, wherein the first external electric signal is a control signal for controlling displacement of a variable displacement compressor, the control signal determining a differential pressure between a high pressure-side refrigerant pressure and a low pressure-side refrigerant pressure in the variable displacement compressor, and wherein the second external electric signal is a signal for proportionally controlling an area of a refrigerant passage in an expansion device.

10. The method of controlling the refrigeration cycle according to claim 1, wherein the first external electric signal is a control signal for controlling displacement of a variable displacement compressor, the control signal determining the low pressure-side refrigerant pressure in the variable displacement compressor, wherein the differential pressure between the high pressure-side refrigerant pressure and the low pressure-side refrigerant pressure is determined from a sensor for detecting the high pressure-side refrigerant pressure, and wherein the second external electric signal is a control signal for determining a flow rate of refrigerant flowing through an expansion device.

11. The method of controlling the refrigeration cycle according to claim 1, wherein the first external electric signal is a control signal for controlling displacement of a variable displacement compressor, the control signal determining the low pressure-side refrigerant pressure in the variable displacement compressor, wherein the differential pressure between the high pressure-side refrigerant pressure and the low pressure-side refrigerant pressure is determined from a sensor for detecting the high pressure-side refrigerant pressure, and wherein the second external electric signal is a signal for proportionally controlling an area of a

refrigerant passage in an expansion device.

12. The method of controlling the refrigeration cycle according to claim 1, wherein the first external electric signal and the second external electric signal directly measure a value of an electric current flowing through a coil of a first control valve for controlling displacement of a variable displacement compressor and a value of an electric current flowing through a coil of a second control valve for controlling an expansion device, and based on the measured current values, the differential pressure between the high pressure-side refrigerant pressure and the low pressure-side refrigerant pressure in the refrigeration cycle and the flow rate of refrigerant flowing therethrough are estimated.

13. The method of controlling the refrigeration cycle according to claim 1, wherein the driving torque of the compressor estimated based on the differential pressure, the flow rate of refrigerant, and the engine rotational speed is used for control of engine output torque.

14. A method of controlling a refrigeration cycle, characterized in that energy of the refrigeration cycle is controlled by estimating a compressor variable displacement ratio and driving torque of a compressor

based on a first external electric signal for controlling a differential pressure between a high pressure-side refrigerant pressure and a low pressure-side refrigerant pressure in the refrigeration cycle or a flow rate of refrigerant flowing therethrough, a second external electric signal for controlling a size of a refrigerant passage in the refrigeration cycle, and an engine rotational speed.